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<p>Hydraulic motors Hydraulic motorized wheel can add traction to trailer wheels, unit free-wheels when not needed and during travel at high road speeds. JL70-1-76 704510</p> <p>Hydraulic systems By having the latest developments in hydraulic systems design, the Boeing 747 becomes the first commercial airliner with fully powered flight controls without manual reversion. JL70-4-54 704545</p> <p>Monopropellant turbopumps can back up hydraulic power supplies. JL70-6-46 704570</p> <p>Corrosion cuts burst rating of hydraulic brake lines. JL70-7-50 704583</p>	<p>Instrumentation Cyclic dispersion of spark-ignition engines can now be measured by a simple electronic gating and counting unit. JL70-3-34 704526</p> <p>Instrument panels Pendulum impact machine has been designed to evaluate knee-to-instrument-panel impacts. JL70-7-40 704580</p> <p>Instruments see also: Aircraft instruments Dynamometers Torque meters Recent laser developments may affect future vehicle design, but we cannot predict how. JL70-9-38 704599</p> <p>Intake systems Better breathing improves two-stroke engine power. JL70-7-18 704574</p> <p>Involute splines New ANSI involute spline standard provides major improvements. JL70-1-78 704511</p> <p>Iron see: Cast iron Nodular iron</p>	<p>Lasers Soviet aerospace manufacturing technology is generally as advanced as that in West, and is ahead in certain fields. JL70-3-56 704534</p> <p>Rear obstacle detector and warning unit containing semiconductor infrared laser and semiconductor detector proves capable of spotting small objects up to 10 ft directly behind the vehicle, and warning the driver. JL70-4-62 704548</p> <p>Recent laser developments may affect future vehicle design, but we cannot predict how. JL70-9-38 704599</p> <p>Launch vehicles Low cost rockets need commercial management, construction methods. JL70-4-37 704539</p> <p>Lead Switch to unleaded fuel offers benefits, poses problems. JL70-8-17 704586</p> <p>Life support systems Hydrophobic-hydrophilic zero-gravity hydrogen separator developed for use with spacecraft life-support systems proved successful on Apollo 11. JL70-1-74 704509</p> <p>Environmental control system of Apollo spacecraft worked satisfactorily thanks to redesigned hardware. JL70-5-42 704556</p>
<p>I</p> <p>Icing Little planes, growing up, start wearing big brother's equipment. JL70-6-38 704567</p> <p>Ignition Cyclic dispersion of spark-ignition engines can now be measured by a simple electronic gating and counting unit. JL70-3-34 704526</p> <p>Impact sleds Contoured rigid-foam support proved best head protection for guinea pigs exposed to high deceleration. JL70-1-47 704502</p> <p>Impact tests Contoured rigid-foam support proved best head protection for guinea pigs exposed to high deceleration. JL70-1-47 704502</p> <p>Impact tests show restraining force of legs might be used to reduce crash effects. JL70-2-32 704514</p> <p>Light-weight plastic infant safety carrier developed by General Motors protects its small charge during normal driving, sudden stops, and many vehicle impact conditions. JL70-4-40 704540</p> <p>High-performance bucket and bench seat designs have been developed and specific recommendations for a safety seat have been formulated. JL70-6-24 704563</p> <p>Fractures of a frontal skull bone and a typical facial bone are being duplicated by means of special headforms, which are impacted against suitable surfaces in a drop test facility. JL70-7-32 704577</p> <p>Pendulum impact machine has been designed to evaluate knee-to-instrument-panel impacts. JL70-7-40 704580</p> <p>Some preliminary design considerations in the application of natural rubber for automobile bumpers. JL70-12-30 704622</p>	<p>J</p> <p>Jet aircraft operation Present fuel hydrants can't meet demands of thirsty jumbo jets. JL70-5-60 704561</p> <p>The Mayor's Task Force on Noise Control has developed a series of recommendations for effective action against the many sources of New York City noise, among which truck and aircraft noise—as discussed here—plays a prominent part. JL70-8-27 704587</p> <p>Jet fuels Dilution restores lubricity to hydrotreated jet fuels. JL70-4-42 704541</p>	<p>Lighting see also: Headlamps Lamps Simple projector lamp, with automatic shutter to cut off part of beam—preventing glare for oncoming driver—more than doubles driver's seeing distance along outside of road. JL70-3-40 704528</p> <p>Lubrication Diagnosing engine trouble takes instrumentation and sharp eyes. JL70-8-38 704591</p> <p>Lubricants see: Crankcase oils Oil additives Synthetic lubricants</p>
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<p>Maintainability Ni-Cd batteries need regular maintenance of electrolyte and connections. Just as important, they must be kept from overheating: a few charge cycles at 160 F will kill them. JL70-7-54 704585</p> <p>Management Low cost rockets need commercial management, construction methods. JL70-4-37 704539</p> <p>Manufacturing American mini cars, Vega, Pinto, Gremlin debut—introducing aluminum engines, totally enclosed gearshifts, and robot welding of bodies. JL70-10-43 704610</p> <p>Marine engines When converting aircraft gas turbines to surface use, the design must change to satisfy new service criteria. JL70-3-48 704531</p> <p>Materials testing Simple puncture test points up benefits of integral-skin foams. JL70-4-66 704549</p> <p>Metal forming see also: Casting Extrusion Forging Shear spinning displaces metal axially only, preserving original diameter. Setups must be accurate, but quality is assured—off size parts break up while only partly formed. JL70-2-43 704517</p> <p>Powder metal nickel superalloys may be formed superplastically. JL70-4-59 704547</p> <p>Closed-die forming process brings use of superplastic alloys closer. JL70-9-44 704601</p> <p>Metric system Britain pushing switch to metric. Canada lags, awaits move by U.S. JL70-2-46 704518</p> <p>British experience in converting to metric. JL70-10-31 704608</p> <p>Following standard rules eases metric/inch dual dimensioning. JL70-11-32 704615</p> <p>Military vehicles Army's unconventional transport for cargo and troops keeps six powered wheels on ground over rough terrain by bending and twisting at articulation between units. JL70-3-46 704530</p> <p>All-terrain vehicle is generally a 6-wheel bathtub full of engineering features. JL70-11-15 704611</p> <p>Mobility research Snow mobility design tolerates no compromise with environment. JL70-9-46 704602</p> <p>Models Innovations lend speed and precision to wind tunnel tests. JL70-3-62 704535</p> <p>Moldings Door trim panels, lamp housings—new polypropylene applications. JL70-3-38 704527</p>	<p>Mounts Lab tests show three practical ways to reduce engine noise: shield noise sources, isolate them, and build in smoother operation. Experiments show they work. JL70-4-20 704536</p> <p style="text-align: center;">N</p> <p>Nadyne generators Prototypes demonstrate the organic rankine cycle in compact electrical generators. Choice of working fluid is hard and important—could be eased by synthesis of new fluids. JL70-6-58 704573</p> <p>NASA space program see: Apollo project</p> <p>Nickel alloys Alternative carburizing steels with reduced nickel are listed. JL70-3-50 704532</p> <p>Powder metal nickel superalloys may be formed superplastically. JL70-4-59 704547</p> <p>Unique production problems encountered in development of NERVA space engine. JL70-10-22 704606</p> <p>Nodular iron Exhaustive tests in the lab and on vehicles proved out the careful design of a cast iron steering knuckle designed for the heaviest line of limousines and ambulances. JL70-6-43 704569</p> <p>Noise Lab tests show three practical ways to reduce engine noise: shield noise sources, isolate them, and build in smoother operation. Experiments show they work. JL70-4-20 704536</p> <p>The Mayor's Task Force on Noise Control has developed a series of recommendations for effective action against the many sources of New York City noise, among which truck and aircraft noise—as discussed here—plays a prominent part. JL70-8-27 704587</p> <p>Nondestructive testing see: Ultrasonics</p> <p>Nuclear power systems Probabilistic techniques provide required reliability for NERVA rocket engine. JL70-9-35 704598</p> <p>Unique production problems encountered in development of NERVA space engine. JL70-10-22 704606</p> <p style="text-align: center;">O</p> <p>Octane number see: Knock</p> <p>Oil additives Organo-metallic oil additives linked to surface ignition. JL70-7-36 704578</p>	<p>Oil consumption Two-ring piston for diesel engines proves successful in lab and road tests. First application is on Caterpillar 1100 truck engine. JL70-4-44 704542</p> <p>Operations research Incremental profit model helps determine design. JL70-2-48 704519</p> <p>Oversnow vehicles Snow mobility design tolerates no compromise with environment. JL70-9-46 704602</p> <p style="text-align: center;">P</p> <p>Passenger car design Emission and safety standards are redirecting trends in European passenger cars. JL70-2-15 704512</p> <p>American mini cars, Vega, Pinto, Gremlin debut—introducing aluminum engines, totally enclosed gearshifts, and robot welding of bodies. JL70-10-43 704610</p> <p>Some preliminary design considerations in the application of natural rubber for automobile bumpers. JL70-12-30 704622</p> <p>Photography Color movies help engineers see what goes on in diesel chamber during combustion process. JL70-1-52 704503</p> <p>Pistons/piston rings Water-soluble cores can provide oil cooling passages in diesel piston crowns. JL70-1-68 704508</p> <p>Two-ring piston for diesel engines proves successful in lab and road tests. First application is on Caterpillar 1100 truck engine. JL70-4-44 704542</p> <p>Diagnosing engine trouble takes instrumentation and sharp eyes. JL70-8-38 704591</p> <p>Plastics Contoured rigid-foam support proved best head protection for guinea pigs exposed to high deceleration. JL70-1-47 704502</p> <p>Hydrophobic-hydrophilic zero-gravity hydrogen separator developed for use with spacecraft life-support systems proved successful on Apollo 11. JL70-1-74 704509</p> <p>Door trim panels, lamp housings—new polypropylene applications. JL70-3-38 704527</p> <p>Simple puncture test points up benefits of integral-skin foams. JL70-4-66 704549</p> <p>Porous materials see: Powder metallurgy/powder metals Powder metal nickel superalloys may be formed superplastically. JL70-4-59 704547</p> <p>Aluminum powder-metal alloys offer the advantages of powder metals without diminishing typical aluminum strength, corrosion resistance, and machinability properties. JL70-6-40 704568</p>
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<p>Powerplants see:</p> <ul style="list-style-type: none"> Aluminum engines Compound engines Diesel engines Dual fuel engines External combustion engines Gas engines Gasoline engines Industrial engines Marine engines Racing engines Rocket engines Small engines Spark ignition engines Steam engines Stirling cycle engines Turbine engines Turboshaft engines Two stroke cycle engines Variable compression ratio engines Wankel rotating combustion engines <p>Power transmission see:</p> <ul style="list-style-type: none"> Transmissions <p>Preignition Organo-metallic oil additives linked to surface ignition. JL70-7-36 704578</p> <p>Pressure vessels Probabilistic techniques provide required reliability for NERVA rocket engine. JL70-9-35 704598</p> <p>Probability theory Probabilistic techniques provide required reliability for NERVA rocket engine. JL70-9-35 704598</p> <p>Pumps see also:</p> <ul style="list-style-type: none"> Fuel injection Dilution restores lubricity to hydrotreated jet fuels. JL70-4-42 704541 Direct connection between turbine and fuel pump eliminates weight and frontal area of reduction gears but trouble comes with low efficiency at start-up and maximum power. JL70-4-56 704546 Monopropellant turbopumps can back up hydraulic power supplies. JL70-6-46 704570 	<p>Radar Electronic technology is catching up with the concept of broadcasting radar scope images via television. But obstacles remain, notably adverse opinion of some pilots. JL70-2-38 704515</p> <p>Radiators see:</p> <ul style="list-style-type: none"> Heat exchangers <p>Rankine cycle Prototypes demonstrate the organic rankine cycle in compact electrical generators. Choice of working fluid is hard and important—could be eased by synthesis of new fluids. JL70-6-58 704573</p> <p>Advanced automotive power systems program will deliver two virtually nonpolluting automobile engines by 1975. JL70-12-40 704619</p> <p>Reflectors Probabilistic techniques provide required reliability for NERVA rocket engine. JL70-9-35 704598</p> <p>Regulations Safer air taxi operation is goal of new airworthiness standards for small aircraft. JL70-1-59 704504</p> <p>Though diesel powered construction equipment contributes little to total air pollution, earthmoving equipment is confronted by tightening smoke level regulations. JL70-5-35 704553</p> <p>Possible increase in power-weight ratio and permitted weights are already influencing British commercial vehicle design. JL70-12-16 704618</p> <p>Reliability Liability for product defects extends to engineering design. JL70-6-35 704566</p> <p>Probabilistic techniques provide required reliability for NERVA rocket engine. JL70-9-35 704598</p> <p>Research see:</p> <ul style="list-style-type: none"> Crash research Mobility research Operations research <p>Ride evaluation Molding with high strength rubber produces a cordless tire with large cornering stiffness, low resonant frequency, a strong carcass, and commercially acceptable endurance. JL70-5-56 704560</p> <p>Active suspension smooths ride of tracked air cushion vehicle. JL70-10-28 704607</p> <p>Rings see:</p> <ul style="list-style-type: none"> Pistons/piston rings <p>Roads see:</p> <ul style="list-style-type: none"> Highways <p>Rocket engines Low cost rockets need commercial management, construction methods. JL70-4-37 704539</p>	<p>Rocket nozzles Unique production problems encountered in development of NERVA space engine. JL70-10-22 704606</p> <p>Rubber/synthetic rubber Some preliminary design considerations in the application of natural rubber for automobile bumpers. JL70-12-30 704622</p> <p>No longer limited to secondary use for isolators, rubber is becoming more popular as the main spring element. Inherent damping and variable spring rates offer advantages. JL70-12-34 704625</p> <p>Recycle process being developed to grind up old tires, dissolve them in new oil, then burn the solution as usual to produce carbon black. JL70-12-43 704627</p> <p style="text-align: center;">S</p> <p>Safety see:</p> <ul style="list-style-type: none"> Aircraft safety Antiskid devices Crash research Driver behavior Impact sleds Safety belts Traffic safety Vehicle safety <p>Safety belts Contoured rigid-foam support proved best head protection for guinea pigs exposed to high deceleration. JL70-1-47 704502</p> <p>Impact tests show restraining force of legs might be used to reduce crash effects. JL70-2-32 704514</p> <p>Data from anthropometric device help designer place controls within restrained driver's reach. JL70-9-42 704600</p> <p>Safety devices Light-weight plastic infant safety carrier developed by General Motors protects its small charge during normal driving, sudden stops, and many vehicle impact conditions. JL70-4-40 704540</p> <p>Scavenging Better breathing improves two-stroke engine power. JL70-7-18 704574</p> <p>Seals see:</p> <ul style="list-style-type: none"> Pistons/piston rings <p>Seats see also:</p> <ul style="list-style-type: none"> Aircraft seats <p>High-performance bucket and bench seat designs have been developed and specific recommendations for a safety seat have been formulated. JL70-6-24 704563</p> <p>American mini cars, Vega, Pinto, Gremlin debut—introducing aluminum engines, totally enclosed gearshifts, and robot welding of bodies. JL70-10-43 704610</p> <p>Signal lights Computer controls increase traffic through tunnel. JL70-2-50 704520</p> <p>Simulation see:</p> <ul style="list-style-type: none"> Computer simulation
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<p>Small engines Highly developed motorcycle racing engines agree remarkably well with theoretical predictions of increased power when displacement is divided among more and smaller cylinders. JL70-5-39 704555</p>	<p>Steering New chrysler steering column has omnidirectional energy-absorbing capability and also an antitheft lock. JL70-2-54 704522</p>	<p>American mini cars, Vega, Pinto, Gremlin debut—introducing aluminum engines, totally enclosed gearshifts, and robot welding of bodies. JL70-10-43 704610</p>
<p>Spacecraft see: Apollo project Lunar vehicles</p>	<p>Starting in 1971, four Apollo flights will carry a 2-man roving vehicle which will enable the astronauts to explore farther and faster than on foot. At the invitation of NASA, four contractors submitted proposals, described in this article. JL70-5-21 704551</p>	<p>No longer limited to secondary use for isolators, rubber is becoming more popular as the main spring element. Inherent damping and variable spring rates offer advantages. JL70-12-34 704625</p>
<p>Spacecraft radiators Environmental control system of Apollo spacecraft worked satisfactorily thanks to redesigned hardware. JL70-5-42 704556</p>	<p>Exhaustive tests in the lab and on vehicles proved out the careful design of a cast iron steering knuckle designed for the heaviest line of limousines and ambulances. JL70-6-43 704569</p>	<p>Synthetic lubricants High-temperature performance, wear protection, and deposit control will be of increased importance for engine oils of the near future. JL70-12-23 704623</p>
<p>Space environment see: Zero gravity</p>	<p>American mini cars, Vega, Pinto, Gremlin debut—introducing aluminum engines, totally enclosed gearshifts, and robot welding of bodies. JL70-10-43 704610</p>	<p style="text-align: center;">T</p> <p>Test equipment Brakes make fine dynamometer for very-low-speed axles. JL70-5-46 704557</p>
<p>Spark ignition engines Cyclic dispersion of spark-ignition engines can now be measured by a simple electronic gating and counting unit. JL70-3-34 704526</p>	<p>Stirling cycle engines California Air Resources Board adopts tight emission standards for 1975 cars sold in California. JL70-3-28 704524</p>	<p>Fractures of a frontal skull bone and a typical facial bone are being duplicated by means of special headforms, which are impacted against suitable surfaces in a drop test facility. JL70-7-32 704577</p>
<p>Splines see: Involute splines</p>	<p>Advanced automotive power systems program will deliver two virtually nonpolluting automobile engines by 1975. JL70-12-40 704619</p>	<p>Pendulum impact machine has been designed to evaluate knee-to-instrument-panel impacts. JL70-7-40 704580</p>
<p>Sports cars Emission and safety standards are redirecting trends in European passenger cars. JL70-2-15 704512</p>	<p>Stol aircraft Compound helicopter and stol airplane are being considered for high-volume short-haul transportation. JL70-4-28 704537</p>	<p>Data from anthropometric device help designer place controls within restrained driver's reach. JL70-9-42 704600</p>
<p>Springs Active suspension smooths ride of tracked air cushion vehicle. JL70-10-23 704607</p> <p>No longer limited to secondary use for isolators, rubber is becoming more popular as the main spring element. Inherent damping and variable spring rates offer advantages. JL70-12-34 704625</p>	<p>Structures see: Aircraft structures</p> <p>Superalloys Powder metal nickel superalloys may be formed superplastically. JL70-4-59 704547</p> <p>Unique production problems encountered in development of NERVA space engine. JL70-10-22 704606</p>	<p>Testing see: Flight testing Impact tests Materials testing Wind tunnel testing</p>
<p>Standardization New ANSI involute spline standard provides major improvements. JL70-1-78 704511</p>	<p>Supercharging/superchargers see: Turbcharging/turbochargers</p>	<p>Tests Instrumented roadwheel test, originally developed by Goodrich about three years ago, has been modified to give more valid values for tire dynamic strength. JL70-1-64 704506</p>
<p>Basic seat structure modified as needed by adding appropriate parts helps to solve the problem of low-production volume for one manufacturer of general aviation aircraft. JL70-12-32 704620</p>	<p>Supersonic transports Fast tests adequately predict fatigue life of titanium on SST. JL70-5-37 704554</p>	<p>Fast tests adequately predict fatigue life of titanium on SST. JL70-5-37 704554</p>
<p>Statistics see: Probability theory</p>	<p>Surface ignition Organo-metallic oil additives linked to surface ignition. JL70-7-36 704578</p>	<p>SAE Tire Committee studies effect of tire wear on wet pavement traction. JL70-7-44 704581</p>
<p>Steam engines California Air Resources Board adopts tight emission standards for 1975 cars sold in California. JL70-3-28 704524</p>	<p>Suspension systems Emission and safety standards are redirecting trends in European passenger cars. JL70-2-15 704512</p>	<p>Thermodynamics Prototypes demonstrate the organic rankine cycle in compact electrical generators. Choice of working fluid is hard and important; could be eased by synthesis of new fluids. JL70-6-58 704573</p>
<p>Steam engines again? Yes—but with a new approach. JL70-10-37 704609</p>	<p>Starting in 1971, four Apollo flights will carry a 2-man roving vehicle which will enable the astronauts to explore farther and faster than on foot. At the invitation of NASA, four contractors submitted proposals, described in this article. JL70-5-21 704551</p>	<p>Thrust reversal Mechanical aspects of thrust reversers and how they are affected by design limits, objectives, and materials. JL70-6-48 704571</p>
<p>Steels See also: Alloy steels Material properties improve when steel is continuously cast. JL70-3-43 704529</p>	<p>Active suspension smooths ride of tracked air cushion vehicle. JL70-10-28 704607</p>	<p>Tires Instrumented roadwheel test, originally developed by Goodrich about three years ago, has been modified to give more valid values for tire dynamic strength. JL70-1-64 704506</p>

Emission and safety standards are redirecting trends in European passenger cars. JL70-2-15 704512	Transport aircraft see: Supersonic transports	Direct connection between turbine and fuel pump eliminates weight and frontal area of reduction gears but trouble comes with low efficiency at startup and maximum power. JL70-4-56 704546
Tires react in known ways to radial, axial, and tractive forces. All three are related and depend on construction. JL70-4-50 704544	Transportation Jumbo jets bring crisis in ground access to airports. JL70-1-40 704501	Little planes, growing up, start wearing big brother's equipment. JL70-6-38 704567
Molding with high strength rubber produces a cordless tire with large cornering stiffness, low resonant frequency, a strong carcass, and commercially acceptable endurance. JL70-5-56 704560	Survey in Minneapolis-St. Paul shows public wants better bus service but is not willing to pay for it. JL70-9-25 704595	Possible increase in power-weight ratio and permitted weights are already influencing British commercial vehicle design. JL70-12-16 704618
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